CONCENTRIC ARCH STRUCTURES OF THE ARAL SEA AREA AND KYZYLKUM AS SEEN IN SPACE PHOTOGRAPHS TAKEN FROM THE MANNED ORBITAL STATION SALYUT

S. Shul'ts, Jr.

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16. Abstract

Interpretation of space photographs of the Aral Sea area and Kyzylkum, taken from the manned satellite Salyut reveals many previously unknown structural features of the continental crust, including many concentric structures on shields of ancient and young platforms. The original structure of such formations are discussed.

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CONCENTRIC ARCH STRUCTURES OF THE ARAL SEA AREA AND KYZYLKUM AS SEEN IN SPACE PHOTOGRAPHS TAKEN FROM THE MANNED ORBITAL STATION SALYUT

S. Shul'ts, Jr.

The remote observations of the Earth from space painted a largely new /1* picture of the continents and made it possible to discover many previously unknown structures of the continental crust. One of the most interesting and surprising results of decoding space photographs was the discovery in the most different of regions of a large number of concentric structures measuring in diameter from a few kilometers to a few hundred of kilometers. These structures are especially clear on shields of ancient and young platforms and in regions of shallow (1 to 2 kilometers from the surface) deposition of the foundation beneath the platform mantle. Some of these structures were formed as the result of the invasion of dome-shaped or ring-shaped intrusions and subvolcanic complexes and are reflections in relief of granite-gneiss domes, volcanic craters, subsidence calderas on top of ring-shaped volcanic structures and other formations of magmatic origin.

The origin of other concentric structures, in particular large flat arch uplifts, often more than 100 kilometers in diameter, is less obvious. An entire series of such concentric structures, often located one inside another, can be clearly seen in space photographs of the eastern part of the Turanskaya plate in the Kyzylkum Desert, southeastern and eastern Aral Lake region, lower and middle course of the Syr-Dar'ya River. The diameter of the structures varies from 20-30 to 130-150 kilometers. Most of the structures have a strictly concentric form; some of them are elongated somewhat in the latitudinal or northwest direction. Certain concentric structures can be traced very clearly on the photographs and have distinct boundaries; others are less distinct and "shine" through Quaternary and Eolian depositions of the eastern Kyzylkum. /2 Deciphering of space photographs of the central and northeastern Kyzylkum and eastern Aral reveals the following concentric structures:

*Numbers in the margin indicate pagination in the foreign text.

I. The Bukan concentric arch uplift (Figure 1.I) about 110 kilometers in diameter, including the western and central parts of mountains and their northern and southwestern foothills.

II. The Tobabergen concentric arch uplift (Figure 1.II), about 20 mm in diameter, located within the northwestern part of the Bukan uplift.

III. The Irlir concentric arch uplift (Figure 1.III) 45 kilometers in diameter, located inside the northeastern part of the Bukan uplift in the vicinity of Bokalinskiy granodiorite mountain and Irlir uplands.

IV. The Tamdy concentric arch uplift (Figure 1.IV), 150 kilometers in diameter, including Tamdytau Mountain, except for its extreme northeastern extremity, and Auminzatau Mountain.

V. The Aktau concentric structure (Figure 1.V), about 40 kilometers in diameter, located in the northeastern part of the Tamdynskiy Mountains in the northeastern peripheral part of the Tamdy concentric uplift, asymmetrically with respect to its center.

Uplifts are covered by the sands of the northeastern Kyzylkumy and Quaternary alluvial sediments are considerably less distinct on the photographs.

VI. The Koksengir concentric structure (Figure 1.VI), about 130 kilometers in diameter, the center of which is located 90 to 100 kilometers south of Kzylord Mountains.

VII. The middle Syrdar'inskoye arch uplift (Figure 1.VIII), about 120 kilometers in diameter.

Analysis of the existing geological and geophysical data indicates that the above concentric structures are flat arches of Paleozoic rocks of the folded foundation and sedimentary mantle. The vertical amplitude of uplift varies from a few hundred meters to a few kilometers. The similarity of the shape of the concentric structures that are superimposed on the linear west-northwestern structures of the folded foundation and the system of faults of north-northeast, meridional and latitudinal strike, that complicate and displace them, is a surprising feature. The contours of contemporary outcroppings of Paleozoic, Cretaceous and Paleogenic rocks, reflected on the geological map, are the

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overall result of young tectonic shifts that inherit part of the plan of the concentric structures and part of the orientation of the network of linear folded and fractured structures of the Paleozoic foundation. In many cases the concentric structures are clearly superimposed on linear folded structures of the foundation and are younger than the latter; however they are cut by more recent faults of northeast strike. Comparison of the space photographs with charts of anomalies of gravity and the magnetic field indicates that these concentric structures are clearly reflected on the photographs, and their interiors are often characterized by negative magnetic and gravitational anomalies, while their peripheries are characterized by positive anomalies.

The concentric structures of the Kyzylkumy and Aral Sea area most probably developed during the final stages of formation of the Paleozoic folded structures of the Ural-Tyan'shan' belt; the prolonged upbulging of these arches, which continues to take place at a slow rate even today, is apparently the result of isostatic equalization of the upper horizons of the continental crust above areas of accumulation of low-density masses in the lower parts of the crust, and perhaps even in the mantle.

Captions to Figures

Figure 1. Ia, Space Photograph of the Eastern Aral Sea Area, Northern and Central Kyzylkumy, Taken from Manned Space Station Salyut. /4

Ib, Diagram of concentric structures deciphered on photographs; outcroppings of folded Paleozoic foundation are crosshatched in the diagram. Roman numerals designate the structures: I, Bukan; II, Tobabergen; III, Irlir; IV, Tamdy; V, Altau; VI, Koksengir; VII, middle Syrdar'inskiy arch.

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